

Page



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/608,852	06/30/2000	Kiran A. Padwekar	042390.P5563	1971

7590 07/12/2004

Michael A DeSanctis  
Blakely Sokoloff Taylor & Zafman LLP  
12400 Wilshire Boulevard  
7th Floor  
Los Angeles, CA 90025

EXAMINER
----------

LI, AIMEE J

ART UNIT	PAPER NUMBER
----------	--------------

2183

DATE MAILED: 07/12/2004

13

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/608,852

Applicant(s)

PADWEKAR, KIRAN A.

Examiner

Aimee J Li

Art Unit

2183

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 27 May 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 8,9,14,15 and 21-37 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 8,9,14,15 and 21-37 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### DETAILED ACTION

1. Claims 8-9, 14-16, 21-27 and new claims 28-37 have been considered. Claims 17-20 have been cancelled per Applicant's request. New claims 28-37 have been added.

#### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 8-9, 14-16, 21-24, 28-29, and 33-34 are rejected under 35 U.S.C. 102(e) as being taught by Lempel, U.S. Patent Number 5,978,909 (herein referred to as Lempel).

4. The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

5. Referring to claim 8, Lempel has taught a method, comprising:

- a. Speculatively allocating a first branch entry for a conditional branch in a speculative branch target buffer (SBTB) prior to execution of the conditional branch responsive to decoding the conditional branch and finding no branch entry

Art Unit: 2183

- in an architectural branch target buffer (ABTB) corresponding to the conditional branch (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2);
- b. Speculatively allocating a second branch entry for the conditional branch in the SBTB responsive to a subsequent failed attempt to locate a branch entry in the ABTB corresponding to the conditional branch (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2);
  - c. Allocating a third branch entry for the conditional branch in the ABTB after retirement of the conditional branch (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2); and
  - d. Subsequently performing branch prediction for the conditional branch by determining a predicted target address branch based upon branch data associated with the second branch entry (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2).
6. Referring to claim 9, Lempel has taught speculatively updating branch data associated with the first branch entry after said performing branch prediction for the conditional branch (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2).

Art Unit: 2183

7. Referring to claim 14, Lempel has taught a machine-readable medium having stored thereon data representing sets of instructions, the sets of instructions which, when executed by a machine, cause the machine to:

- a. Speculatively allocate a first branch entry for a conditional branch in a speculative branch target buffer (SBTB) prior to execution of the conditional branch responsive to decoding the conditional branch and finding no branch entry in an architectural branch target buffer (ABTB) corresponding to the conditional branch (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2);
- b. Speculatively allocate a second branch entry for the conditional branch in the SBTB responsive to a subsequent failed attempt to locate a branch entry in the ABTB corresponding to the conditional branch (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2);
- c. Allocate a third branch entry for the conditional branch in the ABTB after retirement of the conditional branch (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2); and
- d. Subsequently perform branch prediction for the conditional branch by determining a predicted target address branch based upon branch data associated with the second branch entry (Lempel column 4, line 53 to column 3, line 23;

Art Unit: 2183

column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7;

Figure 2).

8. Referring to claim 15, Lempel has taught wherein the sets of instructions which, when executed by the machine, further cause the machine to speculatively update branch data associated with the first branch entry after said performing branch prediction for the conditional branch (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2).

9. Referring to claim 21, Lempel has taught a processor, comprising:

- a. A fetch unit to speculatively retrieve instruction data for processing by an instruction pipeline (Lempel column 3, line 47 to column 4, line 8; column 4, lines 20-43; and Figure 1); and
- b. A branch prediction circuit, coupled to the fetch unit, to predict final target addresses for branch instructions contained within the instruction data (Lempel column 4, lines 9-43 and Figure 1), the branch prediction circuit including
  - i. A speculative branch target buffer (SBTB) cache having a plurality of branch entries to maintain speculative branch data associated with in-flight branches, the speculative branch data including a speculative history of taken/not-taken outcomes associated with the in-flight branches (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2), and
  - ii. An architectural branch target buffer (ABTB) cache, coupled to the SBTB cache, the ABTB having a plurality of branch entries to maintain

architectural branch data including the actual taken/not-taken outcomes associated with retired conditional branches (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2).

10. Referring to claim 22, Lempel has taught wherein the SBTB cache comprises a FIFO having entries corresponding to each of a plurality of pipeline stages of the instruction pipeline (Lempel column 4, line 53 to column 3, line 23; column 5, line 15 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2).

11. Referring to claim 23, Lempel has taught wherein the branch data includes a speculative history field representing the speculative taken or not-taken history of the branch for a predetermined window of executions of the branch, and wherein said speculatively updating branch data comprises updating the speculative history field to reflect the taken or not-taken status of its most recent execution (Lempel column 5, line 15 to column 6, line 15 and Figure 3).

12. Referring to claim 24, Lempel has taught wherein the branch data includes a speculative history field representing the speculative taken or not-taken history of the branch for a predetermined window of executions of the branch, and wherein said speculatively updating branch data comprises updating the speculative history field to reflect the taken or not-taken status of its most recent execution (Lempel column 5, line 15 to column 6, line 15 and Figure 3).

13. Referring to claim 28, a branch prediction circuit, comprising:

- a. A speculative branch target buffer (SBTB) cache having a plurality of branch entries to maintain speculative branch data associated with in-flight branches, the speculative branch data including a speculative history of taken/not-taken

outcomes associated with the in-flight branches, wherein the SBTB cache includes a FIFO having entries corresponding to each of a plurality of pipeline stages of a processor instruction pipeline (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2);

- b. An architectural branch target buffer (ABTB) cache coupled to the SBTB cache, the ABTB cache having a plurality of branch entries to maintain architectural branch data including actual taken/not-taken outcomes associated with retired conditional branches (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2); and
  - c. A target address generator coupled to the SBTB cache and the ABTB cache, the target address generator to determine a predicted target address for a branch prediction based upon the speculative branch data and the architectural branch data (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2).
14. Referring to claim 29, Lempel has taught a fetch unit to speculatively retrieve instruction data for processing by the processor instruction pipeline (Lempel column 3, line 47 to column 4, line 8; column 4, lines 20-43; and Figure 1).
15. Referring to claim 33, Lempel has taught a method, comprising:
- a. Maintaining speculative branch data associated with in-flight branches using a speculative branch target buffer (SBTB) cache having a plurality of branch entries, the speculative branch data including a speculative history of taken/not-



Art Unit: 2183

- taken outcomes associated with the in-flight branches, wherein the SBTB cache includes a FIFO having entries corresponding to each of a plurality of pipeline stages of a processor instruction pipeline (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2);
- b. Maintain architectural branch data using a plurality of branch entries of an architectural branch target buffer (ABTB) cache coupled to the SBTB cache, the architectural branch data including the actual taken/not-taken outcomes associated with retired conditional branches (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2); and
- c. Determine a predicted target address for a branch prediction based upon the speculative branch data and the architectural branch data, the determining of the predicted target address is performed using a target address generator coupled to the SBTB cache and the ABTB cache (Lempel column 4, line 53 to column 3, line 23; column 5, line 59 to column 6, line 15; column 6, line 49 to column 7, line 7; Figure 2).
16. Referring to claim 34, Lempel has taught a fetch unit to speculatively retrieve instruction data for processing by the processor instruction pipeline (Lempel column 3, line 47 to column 4, line 8; column 4, lines 20-43; and Figure 1).

***Claim Rejections - 35 USC § 103***

Art Unit: 2183

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. Claims 25-27, 30-32, and 35-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lempel, U.S. Patent Number 5,978,909 (herein referred to as Lempel) as applied to claims 21, 28, and 33 above, in view of Applicant's admitted prior art in the Background of the Invention (herein referred to as Prior Art). Lempel has not taught:

- a. Wherein the SBTB is dual-ported (Applicant's claims 25, 30, and 35);
- b. Wherein the SBTB is single-ported (Applicant's claims 26, 31 and 36); and
- c. Wherein the ABTB is single-ported (Applicant's claims 27, 32, and 37).

19. Prior Art has taught:

- a. Wherein the SBTB is dual-ported (Applicant's claims 25, 30, and 35) (Prior Art page 5, lines 1-5);
- b. Wherein the SBTB is single-ported (Applicant's claims 26, 31 and 36) (Prior Art page 5, lines 1-5); and
- c. Wherein the ABTB is single-ported (Applicant's claims 27, 32, and 37) (Prior Art page 5, lines 1-5).

20. As stated in Prior Art and known to a person of ordinary skill in the art, the reading/writing ports allow the SBTB to be accessed by the various pipeline stages for information (Prior Art page 5, lines 1-5) and it is necessary for the information to be available to the rest of the device for it to function properly. A person of ordinary skill in the art would have

Art Unit: 2183

recognized that the read/write ports allows the information to be accessed by the various pipeline stages and the rest of the device. Therefore, it would have been obvious to a person of ordinary skill in the art at the time this invention was made to incorporate the read/write ports of Prior Art in the device of Lempel to allow information to be accessed by the various pipeline stages and the rest of the device.

### ***Conclusion***

21. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure as follows. Applicant is reminded that in amending in response to a rejection of claims, the patentable novelty must be clearly shown in view of the state of the art disclosed by the references cited and the objections made. Applicant must also show how the amendments avoid such references and objections. See 37 CFR § 1.111(c).

- a. Hoyt et al., U.S. Patent Number 5,584,001 has taught branch predicting with speculative information.
- b. Gochman et la., U.S. Patent Number 5,842,008 has taught branch predicting with speculative information.
- c. Gschwind et al., U.S. Patent Number 6,513,109 has taught predicting predicate instructions with future predicate registers and architectural predicate register.


22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aimee J Li whose telephone number is (703) 305-7596. The examiner can normally be reached on M-T 7:30am-5:00pm.

Art Unit: 2183

23. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (703) 305-9712. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

24. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AJL  
Aimee J. Li  
July 12, 2004



EDDIE CHAN  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2100